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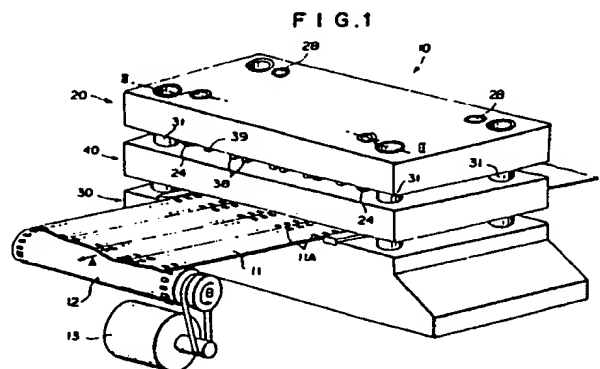
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(54) Web perforating apparatus.

(57) A web perforating apparatus for making holes through a web along its longitudinal direction comprises a die set composed of a die having die cavities and punches, which die and punches are connected together so that they are brought to positions close to but spaced apart from each other through guide members extending in the direction normal to the surface of the web. The die set is provided with a stripper between the die and the punches. The stripper is held so that it is moveable in the direction parallel to the guide members and holds the web when the punches are pulled out of the die cavities. The stripper is provided with punch guide through holes, through which the punches are inserted and which each have a size adapted for a very close tolerance fit with each punch.



## WEB PERFORATING APPARATUS

## BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a web perforating apparatus for making holes through a web so that the holes stand in rows in the longitudinal direction of the web. This invention particularly relates to a web perforating apparatus for simultaneously but accurately making a plurality of holes in a web.

Description of the Prior Art

In order to make holes in a web so that the holes stand in a row in the longitudinal direction of the web, for example, in order to make perforations in photographic films, there have heretofore been widely used web perforating apparatuses wherein a web is moved intermittently in its longitudinal direction, a die having a die cavity is provided on one surface side of the web, and a punch is inserted into the die cavity from the other surface side of the web while the web is stopped. An example of such web perforating apparatuses is disclosed in Japanese Unexamined Patent Publication No. 57-(1982)-41195.

In order to improve the perforating efficiency, it is desirable to move the web intermittently before slitting it into predetermined widths, and to provide a plurality of punches side by side across the width of the web so that a plurality of holes can be made simultaneously through the web. For example, in cases of 35mm photographic films, a 140mm-wide film web may be moved intermittently, and eight punches may be provided side by side across the width of the film web. In this manner, perforations in four 35mm films can be made simultaneously. Also, if many punches are provided side by side in the longitudinal direction of the web, the time per unit length of the web during which the web must be stopped can be shortened, and therefore the perforating efficiency can be improved.

However, with conventional web perforating apparatuses, it is not always easy to make many holes simultaneously when the holes are required to have a high dimensional accuracy, such as perforations in a photographic film. Specifically, in conventional web perforating apparatuses, the punches and die plates are prepared separately. The punches and pilot pins are first secured to the

bottom surface of a vertically moveable ram of a punching machine. Then, the die plate is positioned below the punches, and the ram is manually lowered slowly. At this time, the position of the die plate must be adjusted by visually confirming that the die plate does not interfere with the pilot pins and the punches. After moving the ram up and down several times and confirming that the punches are aligned with the centers of die cavities, the die plate is secured firmly to the punching machine. Therefore, it is very difficult to align the cutting edges of the punches and the die with each other without damaging the punches and the die plate. When the punches are provided side by side across the width of the web and/or in the longitudinal direction thereof it is difficult to position them accurately at the centers of the die cavities. Aligning the cutting edges of the punches and the die with each other can be facilitated by shortening the lengths of the punches. However, because the punches are originally formed so as to be slightly longer than necessary in order to provide an allowance for re-grinding, which will be required after the punches are used for some period of time, the aligning process becomes difficult. Therefore, with the current techniques for perforating, a film is slit from a film web into a required width and is then moved intermittently, and perforations can be made simultaneously only in two rows, each row being located at a side edge portion of the film.

Also, in the aforesaid conventional web perforating apparatus, even if many punches could be provided side by side, the relationship between the position of a punch and its corresponding die cavity becomes incorrect during use. As a result, the punch and the die plate will be damaged through interference therebetween, and the processing accuracy and the cutting performance will deteriorate after a short period of use.

Furthermore, with the aforesaid conventional web perforating apparatus, because of the difficult work required to align the cutting edges of the punches and the die with each other, the operation of the web perforating apparatus must be stopped for long periods of time in order to replace the punches and the die with new ones. Particularly, perforating a photographic film is generally carried out in a darkroom, but aligning the cutting edges of the punches and the die with each other cannot be carried out in the darkroom. Therefore, in this case, light must be allowed to enter the darkroom when the punches and the die are replaced with new ones, and the operation of the web perforating apparatus must be stopped for a longer period of time for this purpose.

## SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a web perforating apparatus wherein a large number of holes are made simultaneously, and a high processing accuracy and good performance in the cutting operation are maintained over a long period of time.

Another object of the present invention is to provide a web perforating apparatus which enables the quick replacement of the punches and die with new ones.

The present invention provides a web perforating apparatus in which a web is moved intermittently in its longitudinal direction, a die having die cavities is provided on one surface side of the web, and punches are inserted into the die cavities from the other surface side of the web while the web is stopped, thereby making holes in the web so that the holes stand in rows in the longitudinal direction of the web,

wherein the improvement comprises:

i) providing a die set comprising said die and said punches which die and punches are connected together so that they are brought to positions close to and spaced apart from each other through guide members extending in the direction normal to the surface of said web,

ii) providing said die set with a stripper between said die and said punches, which stripper is held so that it is moveable in a direction parallel to said guide members and holds said web when said punches are pulled out of said die cavities, and

iii) providing said stripper with punch guide through holes, through which said punches are inserted and which each have a size adapted to correspond to the size of each of said punches.

With the web perforating apparatus in accordance with the present invention, the positions of the punches are adjusted accurately at their base portions, which are secured to the die set, and at the punch guide through holes in the stripper. Because the positions of the punches are each adjusted at two points, even if the punches are originally made slightly longer than necessary in order to provide an allowance for regrinding and even if a large number of punches are provided, they can be made to fit accurately into the die cavities. Therefore, a large number of holes can be made simultaneously with a high accuracy. Also, because the relationship between the positions of the punches and the corresponding die cavities does not easily become incorrect during use, good cutting performance can be maintained over a long period of time, and the working life of the web perforating apparatus can be prolonged because

the punches and the die experience minimal wear.

Furthermore, with the web perforating apparatus in accordance with the present invention wherein the die set comprises the die and the punches connected together through guide members, when the die and the punches are replaced by new ones, the alignment of the cutting edges of the punches and of the die with each other in a new die set can be carried out in advance outside of the perforating system, and the new die set can replace the old die set. Therefore, the time during which the operation of the perforating system is stopped can be shortened markedly, and the efficiency of the perforating operation can be improved.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view showing an embodiment of the web perforating apparatus in accordance with the present invention,

Figure 2 is a sectional view taken along line II-II of Figure 1, and

Figure 3 is a sectional view showing a configuration of a section at which pilot pins are mounted in the web perforating apparatus in accordance with the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will hereinbelow be described in further detail with reference to the accompanying drawings.

With reference to Figures 1 and 2, an embodiment of the web perforating apparatus in accordance with the present invention is constituted for, for example, making perforations along both side edge portions of each of a group of 35mm photographic film strips which have not yet been cut away from each other. The embodiment comprises a die set 10, a sprocket roller 12 for moving a 140mm-wide photographic film web 11, which will later be slit into four 35mm photographic films, in the direction indicated by arrow A in Figure 1, and an operating device 13 for rotating the sprocket roller 12 in the direction indicated by arrow B.

Basically, the die set 10 is composed of an upper assembly 20, a lower assembly 30, and a stripper 40 provided between the upper assembly 20 and the lower assembly 30. By way of example, four guide posts (guide members) 31, 31, ... are secured to the lower assembly 30 so that they protrude upwardly from the lower assembly 30.

The upper assembly 20 and the stripper 40 are guided by the guide posts 31, 31, ... through pole guides 32, 32, ... and pole guides 33, 33, ... The upper assembly 20 is composed of an upper plate 21, and a punch plate 22 secured to the bottom surface of the upper plate 21. The punch plate 22 is provided with four pin receiving holes 23, 23, ... A hollow connection pin 24 is inserted slidably through each of the pin receiving holes 23, 23, ..., and a bolt 25 is fitted and secured in the lower edge portion of the connection pin 24. Lower edge portions of the bolts 25, 25, ... are screwed into the stopper 40 in order to combine the connection pins 24, 24, ... with the stripper 40. Also, the upper plate 21 is provided with spring accommodating holes 26, 26, ... communicating with the pin receiving holes 23, 23, ..., and coiled springs 27, 27, ... are positioned in the spring accommodating holes 26, 26, ... Each coiled spring 27 is contracted between a spring receiver 28, which is secured through threads to the upper edge portion of each spring accommodating hole 26, and a washer 29 combined with each connection pin 24.

A plurality of punches 35, 35, ... are secured to the punch plate 22 of the upper assembly 20 so that they protrude downwardly from the punch plate 22. Each punch 35 has a step-like portion 35a at its base portion. The step-like portion 35a is held by a holding plate 36, and the holding plate 36 is tightened against the punch plate 22 by a bolt 37, thereby securing the punch 35 to the punch plate 22. The punches 35, 35, ... have cross-sectional shapes identical to the shapes of the perforations 11A, 11A, ... which should be made through the photographic film web 11. By way of example, a total of 160 punches are provided so that they form 20 rows spaced apart from one another in the direction of movement of the photographic film web 11 and eight rows spaced apart from one another across the width of the photographic film web 11 in a direction normal to the direction of movement thereof. (The direction of the width of the photographic film web 11 corresponds to the transverse direction in Figure 2.)

On the other hand, the stripper 40 is composed of an insert 41, and a plate 42 on which the insert 41 is secured. The insert 41 is provided with punch guide through holes 43, 43, ..., and the plate 42 is provided with punch guide through holes 44, 44, ... so that the punch guide through holes 43, 43, ... communicate with the punch guide through holes 44, 44, ... The punches 35, 35, ... pass through the punch guide through holes 43, 43, ... and the punch guide through holes 44, 44, ..., and protrude out of the bottom surface of the stripper 40 toward the lower assembly 30.

Also, the punch plate 22 is provided with pilot pins 38, 38, ... behind the punches 35, 35, ..., as

viewed in the direction of movement of the photographic film web 11. The pilot pins 38, 38, ... protrude downwardly from the punch plate 22 in the same manner as the punches 35, 35, ... Lower edge portions of the pilot pins 38, 38, ... are rounded and tapered, and the pilot pins 38, 38, ... are slightly longer than the punches 35, 35, ... By way of example, a total of 16 pilot pins 38, 38, ... are provided so that eight pilot pins 38, 38, ... stand in a row across the width of the photographic film web 11 and another such row is spaced from the aforesaid row, as viewed in the direction of movement of the photographic film web 11. The 16 pilot pins 38, 38, ... are positioned so that they line up with the punches 35, 35, ... and so that the distance between the rear row of the pilot pins 38, 38, ..., as viewed in the direction of movement of the photographic film web 11, and the front row of the punches 35, 35, ..., as viewed in said direction, is equal to the distance between each of the punches 35, 35, ... in said direction. The pilot pins 38, 38, ... pass through guide through holes 39, 39, ..., which are formed in the stripper 40 in the same manner as the punch guide through holes 43, 43, ..., and through guide through holes (not shown) which are formed in the stripper 40 in the same manner as the punch guide through holes 44, 44, ... The pilot pins 38, 38, ... thus protrude downwardly from the stripper 40.

The lower assembly 30 is composed of a lower plate 51 secured to a support plate 50 which constitutes part of the perforating system, and a die insert 52 secured to the upper surface of the lower plate 51. The die insert 52 is provided with die cavities 53, 53, ... matched to the punches 35, 35, ... Each die cavity 53 communicates with a through hole 54 which is positioned under the die cavity 53 and which has a size larger than that of the die cavity 53. Also, on the upper surface of the die insert 52, there are provided a pair of guides 55A and 55B for adjusting the position of the photographic film web 11 at both its side edges, and a plurality of stoppers 56, 56, ... which come into contact with the bottom surface of the stripper 40 when the stripper 40 is moved down.

When the perforations 11A, 11A, ... are made through the photographic film web 11 with the apparatus of the aforesaid embodiment, the photographic film web 11 placed on the die insert 52 is intermittently moved in the direction indicated by the arrow A in Figure 1 by a movement means comprising the sprocket roller 12. The length over which the photographic film web 11 is moved per perforating step is adjusted to be 20 times as long as the interval between two adjacent punches 35, 35, which interval is measured in the direction of movement of the photographic film web 11. A press means 60 coupled with the upper assembly

20 is interlocked with the film movement mechanism through a known means. After the movement of the photographic film web 11 is stopped, the press means 60 is moved down over a predetermined distance. As a result, the upper assembly 20 and consequently the punches 35, 35, ... are moved down, and the stripper 40 is moved down together with the upper assembly 20. Just before the stripper 40 comes into contact with the upper surface of the photographic film web 11, the stripper 40 contacts the stoppers 56, 56, ... and stops. The press means 60 is moved further down, so that the springs 27, 27, ... are contracted, and the punch plate 22 is moved down as it slides along the connection pins 24. When the punch plate 22 continues to move down in this manner, the pilot pins 38, 38, ... first enter perforations 11A, 11A, ... which have already been made by the punches 35, 35, ... Therefore, in cases where the position of the photographic film web 11 is incorrect with respect to the pilot pins 38, 38, ..., and consequently with respect to the punches 35, 35, ..., the position is corrected by the pilot pins 38, 38, ... Thereafter, the punches 35, 35, ... enter the die cavities 53, 53, ... in the die insert 52 and cut through the photographic film web 11. In this manner, 160 perforations 11A, 11A, ... are made simultaneously through the photographic film web 11.

When the punches 35, 35, ... are moved down as described above, because the stripper 40 is kept stationary, the punches 35, 35, ... move through the punch guide through holes 43, 43, ... and the punch guide through holes 44, 44, ... Each punch guide through hole 43 has a dimension such that a space as small as, for example, 5 $\mu$ m is formed between the inner surface of the punch guide through hole 43 and the outer circumferential surface of each punch 35. Therefore, the punches 35, 35, ... are moved down while they are guided within the punch guide through holes 43, 43, ..., which have a very close tolerance fit with the punches 35, 35, ..., and they can therefore be accurately positioned as they closely approach the die cavities 53, 53, ... Accordingly, even if the punches 35, 35, ... are made slightly longer than necessary for providing an allowance for re-grinding which will be required after they are used for some period of time, they can be fitted accurately into the die cavities 53, 53, ... without interfering with portions of the die insert 52 around the die cavities 53, 53, ...

Thereafter, the press means 60 is moved up, and the punches 35, 35, ... and the pilot pins 38, 38, ... are pulled up out of the perforations 11A, 11A, ... At this time, upward movement of the stripper 40 is begun after the upper surface of the punch plate 22 which is being moved up pushes up the washers 29, 29, ... of the connection pins

24, 24, ... Therefore, if the photographic film web 11 starts to move up with the punches 35, 35, ... because of friction between the perforations 11A, 11A, ... and the punches 35, 35, ..., the stripper 40 holds the photographic film web down, and the punches 35, 35, ... can be drawn out of the perforations 11A, 11A, ...

After the upper assembly 20 and the stripper 40 are moved up to the positions shown in Figure 2, the photographic film web 11 is again moved forward by the predetermined distance by the sprocket roller 12 and the like, and the next perforating step is carried out. By repeating these operations, the perforations 11A, 11A, ... are made in the photographic film web 11 at predetermined intervals in eight rows extending in the longitudinal direction thereof. Thereafter, the 140mm-wide photographic film web 11 is divided into four sections by cutting along the chained lines shown in Figure 1. In this manner, four 35mm photographic film strips having the perforations 11A, 11A, ... in two rows, the rows running along each side edge, are obtained. The guides 55A and 55B adjust the position of the photographic film web 11 so that the perforations 11A, 11A, ... are made at predetermined positions spaced apart from both side edges of the photographic film web 11.

Two reference planes intersecting at right angles may be formed at part of the lower assembly 30, and may be aligned with reference planes on the perforating system side when the die set 10 is installed on the perforating system. In this case, the die set 10 can be installed accurately and quickly.

When re-grinding of the punches 35, 35, ... is carried out many times, their lengths become shorter. Therefore, the differences between the lengths of the punches 35, 35, ... and the pilot pins 38, 38, ... vary. In such a case, as shown in Figure 3, an upper edge portion 38a of each pilot pin 38 may be held by nuts 70 and 71 which mesh with the upper plate 21, and the pilot pin 38 may be secured to the upper assembly 20. A spacer 72 positioned between a step-like portion 38b of each pilot pin 38 and the upper assembly 20 may be replaced with a thicker one in accordance with the length of each punch 35. In this manner, the lower edge of each punch 35 can be kept at a predetermined height with respect to the lower edge of each pilot pin 38.

## Claims

1. A web perforating apparatus in which a web is moved intermittently in its longitudinal direction, a die having die cavities is provided on one surface side of the web, and punches are inserted into the

die cavities from the other surface side of the web while the web is stopped, thereby making holes in the web so that the holes stand in rows in the longitudinal direction of the web wherein the improvement comprises:

i) providing a die set comprising said die and said punches which die and punches are connected together so that they are brought to positions close to and spaced apart from each other through guide members extending in the direction normal to the surface of said web,

ii) providing said die set with a stripper between said die and said punches, which stripper is held so that it is moveable in a direction parallel to said guide members and holds said web when said punches are pulled out of said die cavities, and

iii) providing said stripper with punch guide through holes, through which said punches are inserted and which each have a size adapted to correspond to the size of each of said punches.

2. An apparatus as defined in Claim 1 wherein said die set is provided with pilot pins which enter holes already made through said web and adjust the position of said web, said pilot pins being slightly longer than said punches and positioned behind said punches, as viewed in the direction of movement of said web, and said stripper is provided with guide through holes, through which said pilot pins are inserted and which each have a size adapted for a close tolerance fit with each said pilot pin.

FIG.1

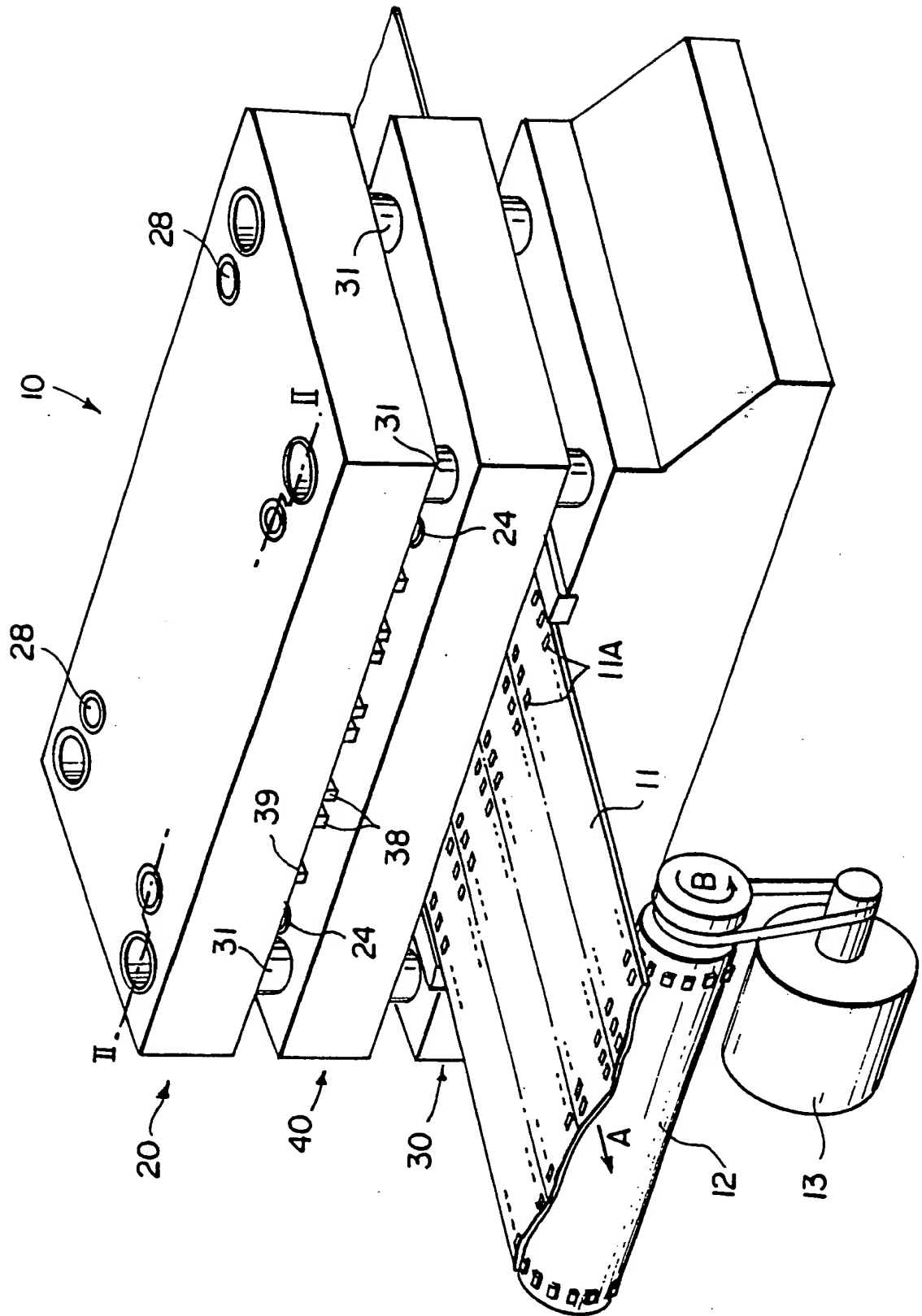


FIG. 2

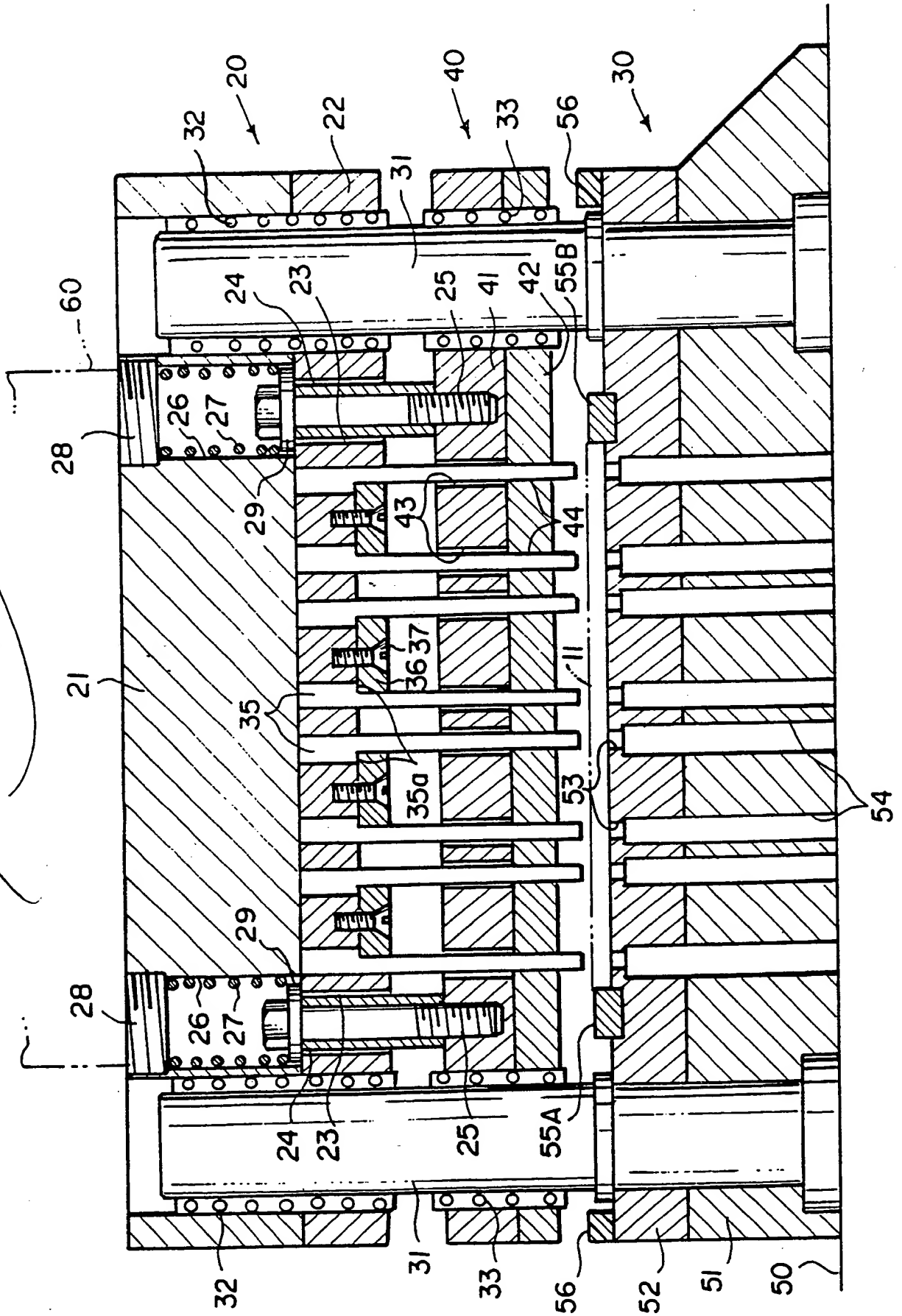
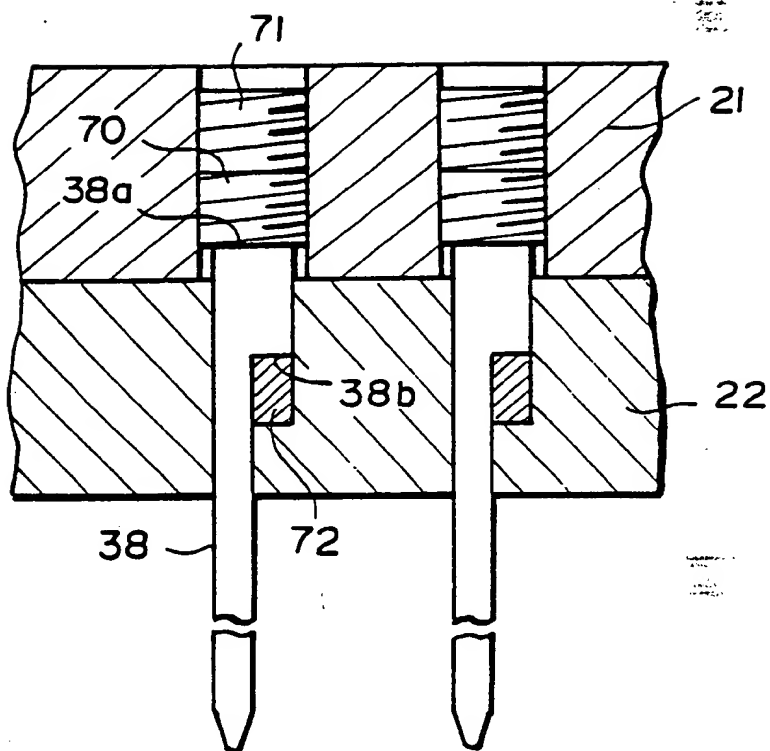




FIG. 3





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12 **EUROPEAN PATENT APPLICATION**

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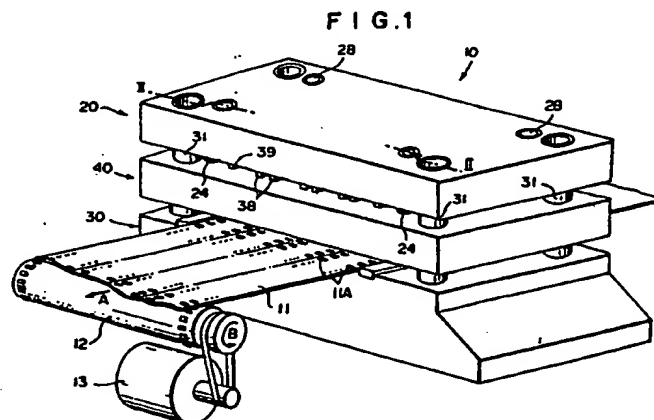
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54 **Web perforating apparatus.**

57 A web perforating apparatus for making holes (11A) through a web (11) along its longitudinal direction comprises a die set (10) composed of a die (30) having die cavities (53) and punches (35), which die and punches are connected together so that they are brought to positions close to but spaced apart from each other through guide members (38) extending in the direction normal to the surface of the web. The die set (10) is provided with a stripper (40) between

the die and the punches. The stripper (40) is held so that it is moveable in the direction parallel to the guide members and holds the web (11) when the punches are pulled out of the die cavities. The stripper is provided with punch guide through holes (44), through which the punches are inserted and which each have a size adapted for a very close tolerance fit with each punch.



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# EUROPEAN SEARCH REPORT

Application Number

EP 89 10 2792

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	GB-A-142204 (SUMMERS HOWELL) * page 1, lines 23 - 32 * * page 2, lines 17 - 24 * * page 3, lines 54 - 57 * * page 4, line 26 - page 5, line 16; figures 1, 13-16 *	1, 2	B26F1/02 B26D7/18
Y	US-A-1782570 (HOWELL) * page 1, lines 4 - 11 * * page 1, lines 46 - 52 * * page 1, line 64 - column 95 * * page 2, lines 38 - 60; figures 1, 2, 4, 5 *	1, 2	
Y	FR-A-2224273 (RAVEL) * figure 4 *	1, 2	
A	US-A-2955066 (WOOD) * column 1, lines 31 - 35 * * column 1, lines 42 - 45 * * column 3, lines 31 - 40; figure 3 *	1, 2	
A	FR-A-404913 (PREVOST) * page 2, lines 61 - 63; figure 4 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	FR-E-11649 (PREVOST) * figure 1 *	1	B26F
A	US-A-1302249 (VOETZER)		
A	DE-C-448337 (I.G. FARBENINDUSTRIE)		
A	DE-C-417958 (ACTIEN-GESELLSCHAFT FUER ANILIN-FABRIKATION IN BERLIN-TREPTOW)		
A	US-A-3545322 (ZYCHAL)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 JUNE 1990	Examiner HUGGINS J.D.
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